CLAIMS

We claim:

1. A chalcogenide device comprising:

a chalcogenide material having a plurality of structural states, said structural states including accumulation states and greyscale states;

a first terminal in electrical communication with said chalcogenide material;

a second terminal in electrical communication with said chalcogenide material;

a third terminal in electrical communication with said chalcogenide material;

wherein said chalcogenide material includes a first portion in a first structural state and a second portion in a second structural state, said first and second structural states being selected from among said accumulation states or said greyscale states.

2. The device of claim 1, wherein said chalcogenide material comprises S, Se, or Te.

3. The device of claim 2, wherein said chalcogenide material further comprises Ge or Sb.

4. The device of claim 2, wherein said chalcogenide material further comprises As or Si.

5. The device of claim 2, wherein said chalcogenide material further comprises an element selected from the group consisting of Al, In, Bi, Pb, Sn, P, and O.

6. The device of claim 2, wherein said chalcogenide further comprises a transition metal.

7. The device of claim 1, wherein the composition of said first portion of said chalcogenide material differs from the composition of said second portion of said chalcogenide material.

8. The device of claim 1, wherein the resistance of said first structural state differs from the resistance of said second structural state.

9. The device of claim 1, wherein said first and second structural states are selected from among said greyscale states.

10. The device of claim 1, wherein said device stores two or more bits of information.

11. The device of claim 10, wherein said bits are non-binary bits.

12. The device of claim 1, wherein said chalcogenide material has a shape having a non-uniform cross section.

13. The device of claim 1, further comprising one or more additional terminals in electrical communication with said chalcogenide material.

14. The device of claim 13, wherein said chalcogenide material further includes a third portion in a third structural state, said third structural state being selected from among said accumulation states or said greyscale states.

15. A method of storing information comprising the steps of

providing a chalcogenide device, said chalcogenide device including:

a chalcogenide material having a plurality of structural states, said structural states including accumulation states and greyscale states;

a first terminal in electrical communication with said chalcogenide material;

a second terminal in electrical communication with said chalcogenide material;

a third terminal in electrical communication with said chalcogenide material;

providing electrical energy between said first terminal and said second terminal, said electrical energy inducing a structural transformation in a first portion of said chalcogenide material from a first of said structural states to a second of said structural states.

16. The method of claim 15, wherein said electrical energy is provided in the form of a current pulse or a voltage pulse.

17. The method of claim 15, wherein said first of said structural states and said second of said structural states are selected from among said greyscale states.

18. The method of claim 15, wherein said first of said structural states or said second of said structural states is the set state of said chalcogenide material.

19. The method of claim 15, wherein said first of said structural states or said second of said structural states is the reset state of said chalcogenide material.

20. The method of claim 15, wherein said first portion of said chalcogenide material is not in physical contact with said third terminal.

21. The method of claim 15, wherein said step of inducing a structural transformation includes the formation of a conductive filament in said first portion of chalcogenide material.

22. The method of claim 21, wherein said conductive filament extends from said first terminal to said second terminal.

23. The method of claim 22, wherein said conductive filament does not extend to said third terminal.

24. The method of claim 15, further comprising the step of

providing electrical energy between said second terminal and said third terminal, said electrical energy inducing a structural transformation of a second portion of said chalcogenide material from a first of said structural states to a second of said structural states.

25. The method of claim 24, wherein said step of inducing a structural transformation in said second portion of said chalcogenide material includes the formation of a conductive filament in said second portion of said chalcogenide material.

26. The method of claim 25, wherein said conductive filament extends from said second terminal to said third terminal.

27. The method of claim 26 wherein said conductive filament does not extend to said first terminal.